

SCIENCE AND ENGINEERING INDICATORS



National Science Board

RAY M. BOWEN

Chairman, President Emeritus, Texas A&M University
and Visiting Distinguished Professor, Rice University

ESIN GULARI

Vice Chairman, Dean of Engineering and Science, Clemson University

MARK R. ABBOTT

Dean and Professor, College of Oceanic and Atmospheric Sciences, Oregon State University

DAN E. ARVIZU

Director and Chief Executive, National Renewable Energy Laboratory

BONNIE BASSLER*

Howard Hughes Medical Institute Investigator and Squibb Professor of Molecular Biology, Princeton University

CAMILLA P. BENBOW

Patricia and Rodes Hart Dean of Education and Human Development, Peabody College of Education and Human Development, Vanderbilt University

JOHN T. BRUER

President, The James S. McDonnell Foundation

FRANCE A. CORDOVA

President, Purdue University

KELVIN K. DROEGEMEIER

Vice President for Research, Regents' Professor of Meteorology and Weathernews Chair Emeritus, University of Oklahoma

PATRICIA D. GALLOWAY

Chief Executive Officer, Pegasus Global Holdings, Inc.

JOSÉ-MARIE GRIFFITHS

Vice President for Academic Affairs and University Professor, Bryant University

LOUIS J. LANZEROTTI*

Distinguished Research Professor of Physics, Center for Solar-Terrestrial Research, Department of Physics, New Jersey Institute of Technology

ALAN I. LESHNER

Chief Executive Officer, American Association for the Advancement of Science, and Executive Publisher, *Science*

W. CARL LINEBERGER

Fellow of JILA, E.U. Condon Distinguished Professor of Chemistry, University of Colorado

G. P. (BUD) PETERSON

President, Georgia Institute of Technology

DOUGLAS D. RANDALL

Professor and Thomas Jefferson Fellow and Director, Interdisciplinary Plant Group, University of Missouri

ARTHUR K. REILLY

Retired Senior Director, Strategic Technology Policy, Cisco Systems, Inc.

ANNEILA I. SARGENT

Benjamin M. Rosen Professor of Astronomy and Vice President for Student Affairs, California Institute of Technology

DIANE L. SOUVAINE

Professor of Computer Science, Tufts University

ARNOLD F. STANCELL

Emeritus Professor and Turner Leadership Chair, Georgia Institute of Technology, School of Chemical and Biomolecular Engineering

CLAUDE M. STEELE

Dean, School of Education, Stanford University

THOMAS N. TAYLOR

Roy A. Roberts Distinguished Professor, Department of Ecology and Evolutionary Biology, Curator of Paleobotany in the Natural History Museum and Biodiversity Research Center, The University of Kansas

RICHARD F. THOMPSON

Keck Professor of Psychology and Biological Sciences, University of Southern California

ROBERT J. ZIMMER

President, University of Chicago

SUBRA SURESH

Member ex officio, Director, National Science Foundation

MICHAEL L. VAN WOERT

Executive Officer, National Science Board, and Director, National Science Board Office

**Board Consultant*

National Science Board Committee on Science and Engineering Indicators

José-Marie Griffiths, *Chair*

Camilla P. Benbow

John T. Bruer

Louis J. Lanzerotti

W. Carl Lineberger

G. P. (Bud) Peterson

Arthur K. Reilly

Richard F. Thompson

Executive Secretaries

Rolf Lehming

Robert Bell

NSB Staff Liaisons

Jean M. Pomeroy

Matthew B. Wilson

SCIENCE AND ENGINEERING INDICATORS 2012



National Science Board

Cover Image

The cover for *Science and Engineering Indicators 2012* was designed and produced by OmniStudio, Inc., Washington, DC.

Recommended Citation

National Science Board. 2012. *Science and Engineering Indicators 2012*. Arlington VA: National Science Foundation (NSB 12-01).

National Science Board

January 13, 2012

MEMORANDUM FROM THE CHAIRMAN OF THE NATIONAL SCIENCE BOARD

TO: The President and Congress of the United States

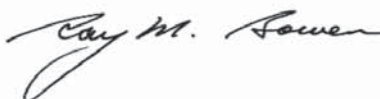
SUBJECT: *Science and Engineering Indicators 2012*

As Chairman of the National Science Board, it is my honor to transmit on behalf of the Board the twentieth in the series of biennial science indicators reports, *Science and Engineering Indicators 2012*. The Board submits this report as required by 42 U.S.C. § 1863 (j) (1).

The Science Indicators series was designed to provide a broad base of quantitative information about U.S. science, engineering, and technology for use by policymakers, researchers, and the general public. *Science and Engineering Indicators 2012* contains analyses of key aspects of the scope, quality, and vitality of the Nation's science and engineering enterprise in the context of global science and technology.

The report presents information on science, mathematics, and engineering education at all levels; the scientific and engineering workforce; U.S. and international research and development performance; U.S. competitiveness in high technology; and public attitudes and understanding of science and engineering. A chapter on state-level science and engineering presents state comparisons on selected indicators. An Overview chapter distills selected key themes emerging from the report.

The Board hopes that both the Administration and Congress find the new quantitative information and analysis in the report useful and timely for informed thinking and planning on national priorities, policies, and programs in science and technology.



Ray M. Bowen
Chairman
National Science Board

Acknowledgments

The National Science Board (NSB) extends its appreciation to the staff of the National Science Foundation and to the many others, too numerous to list individually, who contributed to the preparation of this report.

Primary responsibility for the production of the volume was assigned to Rolf Lehming, Director of the Science and Engineering Indicators Program of the National Center for Science and Engineering Statistics (NCSES); Lynda T. Carlson, Director, NCSES; John R. Gawalt, Deputy Director, NCSES; and Myron P. Gutmann, Assistant Director, Directorate for Social, Behavioral and Economic Sciences. The authors of the manuscript were:

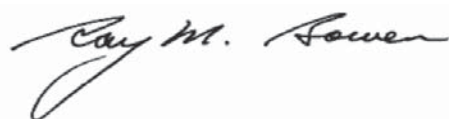
- Overview. Rolf Lehming, NCSES
- Chapter 1. Xianglei Chen, Leslie Hall, Susan Rotermund, Vera Bersudskaya, MPR Associates; Lawrence Burton, NCSES
- Chapter 2. Jaquelina C. Falkenheim, NCSES
- Chapter 3. Robert Bell, Nirmala Kannankutty, Emory P. Morrison, NCSES
- Chapter 4. Mark Boroush, Francisco A. Moris, Raymond M. Wolfe, NCSES
- Chapter 5. Mark Boroush, Lawrence Burton, Mark K. Fiegner, NCSES
- Chapter 6. Derek Hill, NCSES
- Chapter 7. Carolyn L. Funk, SRI International
- Chapter 8. Paula C. Dunnigan, Taratec Corporation; Jeri Mulrow, NCSES

The volume benefited from extensive contributions from NCSES staff. Joan S. Burrelli, Katherine Hale, and Mark C. Regets compiled and analyzed data for the volume. NCSES senior staff and survey managers assured availability of data under often stringent deadlines: Ronda K. Britt, Leslie Christovich, John Finamore, John E. Jankowski, Kelly H. Kang, Lynn Milan, Steven Proudfoot, Emilda B. Rivers, and Michael Yamaner. Jacqueline Durham assisted in acquiring data from outside sources. Stephen Cohen and Jock Black provided advice with statistical or data presentation issues.

In managing production of the volume, Rolf Lehming was assisted by Robert Bell, Nirmala Kannankutty, and Cheryl Roesel. Along with Rolf Lehming, Robert Bell engaged with authors in the development, review, and preparation of chapter content. Nirmala Kannankutty coordinated the schedule for producing the volume. Cheryl Roesel managed the performance of editorial, printing, and publication services. Lynda T. Carlson worked closely with the management team to ensure that the volume was successfully produced.

Robin Pentola was responsible for overall direction and management of the website. Tanya Gore assisted with the final review of the page composition and appendix tables, and Rajinder Raut prepared files for review and provided a technical review of the website. Web design and programming were performed by De Vo, Bridget Tuthill, Jason Shaffer, Moe Than, Makiko Fisher, Micah Horvat, and Richard Ashley of Compuware Corporation. Deborah Collins helped check and review data for Chapter 8 and compiled the list of Acronyms and Abbreviations. Overall editing of the report was performed by David B. Fialkoff and the staff of Lockheed Martin Business Process Solutions. OmniStudio, Inc., Washington D.C., was responsible for design and production of the volume. Many others provided much appreciated advice and assistance and are listed under Contributors and Reviewers.

The National Science Board Office, under the direction of Michael L. Van Woert, provided vital coordination throughout the project. The National Science Board is especially grateful to the S&E Indicators Committee, and Jean M. Pomeroy and Matthew B. Wilson for serving as Liaisons to the Committee. Robert Bell and Rolf Lehming were the Executive Secretaries.



Dr. Ray M. Bowen
Chairman, National Science Board



Dr. José-Marie Griffiths
Chairman, Committee on Science and Engineering Indicators

Contributors and Reviewers

The following persons contributed to the report by reviewing chapters or otherwise assisting in its preparation. Their help is greatly appreciated.

Alice Abreu, International Council for Science
Robert Allen, U.S. Patent and Trademark Office
Nick Allum, University of Essex
Nicole Aspinall, Bloomberg New Energy Finance
Cheikhou Athie, Taratec Corporation
Robert D. Atkinson, Information Technology and Innovation Foundation
Susan L. Aud, National Center for Education Statistics
Samuel F. Barbett, National Center for Education Statistics
Roland Bardon, SRI International
Denise Barnes, National Science Foundation
Kristina Bartsch, Bureau of Labor Statistics
Steven C. Beering, Purdue University
Nathan Bell, Council of Graduate Schools
John Benskin, SRI International
John C. Besley, University of South Carolina
Peter Billington, Higher Education Statistics Agency, Ltd., England
Richard E. Bissell, National Academy of Sciences
Henry Blount, National Science Foundation
Maria Borga, Bureau of Economic Analysis
Nava Brenner, Central Bureau of Statistics, Israel
Prudy Brown, SRI International
David B. Campbell, National Science Foundation
Patricia B. Campbell, Campbell-Kibler Associates, Inc.
Jill Cape, Taratec Corporation
Anthony Carnevale, Georgetown University
Nancy Chan, SRI International
Chiao-Ling Chien, UNESCO Institute for Statistics
Susan Choy, MPR Associates
Patrick Clemins, American Association for the Advancement of Science
Wesley Cohen, Duke University
Daniel Cohen-Vogel, State University System of Florida
Tammy D'Amato, The Patent Board
James J. Duderstadt, University of Michigan
John H. Falk, Oregon State University
Ghislaine Filliatreau, Observatoire des Sciences et des Techniques, Paris
Michael Finn, Oak Ridge Institute for Science and Education
Michael Fix, Migration Policy Institute
Patricia Flynn, Bentley University
John Fraser, The Florida State University
Fred Gault, UNU-MERIT
Donna K. Ginther, University of Kansas
Leonid Gokhberg, Higher School of Economics, Russia
Mary Good, University of Arkansas at Little Rock
Daniel L. Goroff, Alfred P. Sloan Foundation

Kerry Gruber, National Center for Education Statistics
Martin P. Grueber, Battelle
Gary Guenther, Congressional Research Service
Kimberly Hamilton, The Patent Board
Martha Harris, Internal Revenue Service
Robin Henke, MPR Associates
Paul Hitlin, Project for Excellence in Journalism
Ned Howenstine, Bureau of Economic Analysis
Tracy Hunt-White, National Center for Education Statistics
Harold Javitz, SRI International
Mark Jurkowitz, Project for Excellence in Journalism
Scott Keeter, Pew Research Center
Grace Kena, National Center for Education Statistics
Cheryl Kerr, Bureau of Labor Statistics
Beethika Khan, National Science Foundation
Eurry Kim, Internal Revenue Service
Tomoe Kiyosada, SRI International
Kei Koizumi, Office of Science and Technology Policy
Natalia Kovaleva, Higher School of Economics, Russia
Norris Krueger, Entrepreneurship Northwest
J. Steven Landefeld, Bureau of Economic Analysis
Julia Lane, National Science Foundation
Charles F. Larson, Innovation Research International
Bruce V. Lewenstein, Cornell University
Joanna Lewis, Georgetown University
Wendy Li, Bureau of Economic Analysis
James Lightbourne, National Science Foundation
Susan Carol Losh, Florida State University
B. Lindsay Lowell, Georgetown University
Jacques Mairesse, Observatoire des Sciences et des Techniques, Paris
Sunil Mani, Centre for Development Studies, India
Marsha K. McNutt, U.S. Geological Survey
Ram Mudambi, Temple University
Tom Nardone, Bureau of Labor Statistics
Jin Noh, SRI International
Norine E. Noonan, University of South Florida St. Petersburg
Sue Okubo, Bureau of Economic Analysis
Barbara M. Olds, National Science Foundation
Dominic Olivastro, The Patent Board
James C. Palmer, Illinois State University
Jongwon Park, SRI International
Valena Plisko, National Center for Education Statistics
Joshua Powers, Indiana State University
Prem Premakumar, IHS Global Insight
Sean F. Reardon, Stanford University
E.J. Reedy, Kauffman Foundation
Carol Robbins, Bureau of Economic Analysis
Terris Ross, National Center for Education Statistics
Erin Roth, National Center for Education Statistics
Allen Ruby, Institute of Education Sciences, U.S. Department of Education

Mikyung Ryu, American Council on Education
Henry Sauermann, Georgia Institute of Technology
Scott Shane, Case Western Reserve University
Kazuko Shinohara, National Science Foundation, Tokyo
Office
Sean Simone, National Center for Education Statistics
Thomas M. Smith, Vanderbilt University
Laurel Smith-Doerr, Boston University
Thomas Snyder, National Center for Education Statistics
Matthew Soldner, National Center for Education Statistics
Dixie Sommers, Bureau of Labor Statistics
Thomas L. Spreen, Bureau of Labor Statistics
George Stamas, Bureau of Labor Statistics
Madeleine Sumption, Migration Policy Institute
Anton Suslov, Higher School of Economics, Russia
Gregory Tassey, National Institute of Standards and
Technology

Lori Thurgood, SRI International
Christopher P. Toumey, University of South Carolina
Serge Tran, University of California at Los Angeles
Andrew Tyndall, Tyndall Report
Jo Anne Vasquez, Helios Education Foundation
Thomas Weko, National Center for Education Statistics
Vincent Welch, National Opinion Research Center
John A. White, University of Arkansas
Laura Williams, ICF Macro
Sacha Wunsch-Vincent, World Intellectual Property
Organization
Lisa Younger, Small Business Administration
Michael Zastrocky, The Leadership Board for CIO's
Klarka Zeman, Statistics Canada
Ping Zhou, Institute of Scientific and Technical Information of
China, Beijing